

What is claimed is:

1. An optical system comprising:
 - a tunable laser providing a swept optical output;
 - 5 a tracking stage optically coupled to the tunable laser having an optical filter providing a periodic optical signal in response to the swept optical output to a detector providing a periodic electrical signal, wherein the optical filter has a free spectral range of not less than a greatest expected mode hop of the tunable laser.
- 10 2. The optical system of claim 1 wherein the tracking stage provides a second periodic optical signal in quadrature with the periodic optical signal, and the optical system further comprising:
 - a second detector coupled to the second periodic optical signal and providing a second periodic electrical signal;
 - 15 a phase detector coupled to the detector and to the second detector and providing a phase detector signal;
 - a frequency multiplier coupled to the phase detector signal providing a multiplied phase detector signal; and
 - a digital signal processor coupled to the multiplied phase detector signal providing
 - 20 enhanced resolution of the swept optical output.
3. The optical system of claim 1 further comprising a digital signal processor coupled to the periodic electric signal to track the swept optical output over mode hops.
- 25 4. The optical system of claim 1 further comprising a second tracking stage optically coupled to the tunable laser and having a second optical filter providing a second periodic optical signal in response to the swept optical output to a second detector, wherein the second optical filter has a second free spectral range less than the first free spectral range.
- 30 5. The optical system of claim 4 wherein the second free spectral range is selected according to a desired wavelength resolution of the optical system.

6. An optical system comprising:

a tunable laser providing a swept optical output having a discontinuity in output wavelength from a first wavelength at an end of a first continuous tuning range to a second wavelength at a beginning of a second continuous tuning range;

5 a first tracking stage optically coupled to the tunable laser and having a first optical filter providing a first periodic optical signal in response to the swept optical output to a first detector; and

a second tracking stage optically coupled to the tunable laser and having a second optical filter providing a second periodic optical signal in response to the swept optical
10 output to a second detector, wherein the first optical filter has a first free spectral range not less than a difference between the first wavelength and the second wavelength providing tracking of the swept optical output over the discontinuity in output wavelength and the second optical filter has a second free spectral range selected to provide a desired wavelength resolution of the optical system.

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7. The optical system of claim 6 wherein the first free spectral range is sufficiently large to track the swept optical output across a maximum expected mode hop of the tunable laser.

20 8. The optical system of claim 7 wherein the first free spectral range is at least twice the maximum expected mode hop.

9. The optical system of claim 6 wherein the first tracking stage further provides a third periodic optical signal in quadrature with the first periodic optical signal.

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10. The optical system of claim 9 wherein the first free spectral range is less than twice the difference between the first wavelength and the second wavelength.

11. The optical system of claim 9 wherein the second tracking stage further provides a
30 fourth periodic optical signal in quadrature with the second periodic optical signal.

12. The optical system of claim 11 wherein the second free spectral range is between 1 pm and 10 pm to achieve a wavelength resolution of the optical system less than 0.1 pm.

13. The optical system of claim 6 wherein at least one of the first optical filter and the second optical filter comprises a Fabry-Perot optical filter.

5 14. The optical system of claim 6 wherein at least one of the first optical filter and the second optical filter comprises a 3-port fiber interferometer.

15. The optical system of claim 14 wherein the fiber interferometer is a multiple-beam interferometer.

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16. The optical system of claim 6 wherein at least one of the first optical filter and the second optical filter comprises an optical coupler.

17. The optical system of claim 6 further comprising:

15 a digital signal processor coupled to the first detector and to the second detector to determine a direction of a mode hop;

a reference cell optically coupled to the tunable laser; and

a reference detector optically coupled to the reference cell providing an electrical reference signal to the digital signal processor to determine an absolute wavelength of the swept optical output tunable laser.

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18. The optical system of claim 17 further comprising a third detector wherein the swept optical output is configurable to be coupled to a device under test disposed between the tunable laser and the third detector, the third detector being coupled to the digital signal processor to determine a wavelength response of the device under test.

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19. The optical system of claim 17 further comprising:

an optical mixer optically coupled to the tunable laser and to receive an optical signal from a device under test to produce an intermediate optical signal;

30 an intermediate detector coupled to the intermediate optical signal providing an intermediate electrical signal to the digital signal processor.

20. An optical system comprising:

a tunable laser providing a swept optical output;

a first tracking stage optically coupled to the tunable laser and having a first optical filter with a first free spectral range providing a first periodic optical signal in response to the swept optical output to a first detector and a first quadrature signal to a first quadrature detector; and

a second tracking stage optically coupled to the tunable laser and having a second optical filter with a second free spectral range providing a second periodic optical signal in response to the swept optical output to a second detector and a second quadrature signal to a second quadrature detector, wherein the first free spectral range is selected to provide tracking of the swept optical output over a greatest expected mode hop of the tunable laser and the second free spectral range is selected to provide a desired wavelength resolution of the optical system.